Journal of Experimental and Theoretical Physics 1998 vol.87 N2, pages 294-302

Theory of spin diffusion in liquid-phase polymer systems

Fatkullin N., Yatsenko G., Kimmich R., Fischer E.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

A general theory of spin diffusion in condensed media is constructed by the method of Zwanzig-Mori projection operators using the superpositional approximation to decouple the many-particle correlation functions. The spin diffusion coefficient is expressed in the form Dsp =Dtf+Df, where Dtr. is the contribution associated with translational displacements of the molecules and Df is the contribution caused by intermolecular flip-flop processes. The expression for Dtr differs from the well-known Kubo-Green formula for the self-diffusion coefficient Dsd in that the integrand contains an additional factor Pf(t), which is the probability of the molecular spins not participating in intermolecular flip-flop transitions over the time t. A microscopic expression is obtained for Df in the form of a time integral of the intermolecular dipole-dipole dynamic correlation functions. For liquid-phase polymer system with fairly high molecular mass the condition Dsp≫Dsd is satisfied.